

CHAPTER 1

INTRODUCTION

1-1. Purpose. This manual is intended to provide guidance to field offices for the management of water control projects or systems that have been authorized by Congress and planned, designed and constructed by the Corps of Engineers. It also applies to certain aspects of water control projects constructed by other agencies or entities. Technical procedures used in the planning and design of Corps of Engineers projects are well documented in regulations and manuals, and they are done in accordance with established authority. Management of these systems for water control, however, requires special techniques beyond those used in the planning, design and construction phases, to analyze and regulate water conditions at individual projects in order to meet water management objectives.

1-2. Scope

a. General. This manual covers project management related to the hydrologic/hydraulic aspects of completed projects, which are more specifically known as "water control management" activities. These activities include: data collection and handling; determination of project inflow, scheduling releases for flood control, hydropower, water supply, water quality, fish and wildlife; coordination of water management decisions; and determination of releases; i.e., water resource projects are "regulated" to meet water control objectives by "operating" spillway gates, sluice gates, pumping plants, etc. In this regard, the "physical operation" of structures, such as the manipulation of gates or recognition of structural constraints, is addressed only in terms of achieving the water control objectives. The term "operation" is used interchangeably throughout the manual to mean "regulation for water control" such as project release scheduling as well as to mean the "physical operation" of projects. In the same regard, the phrase "project operator" is used interchangeably with "project manager" to refer to the person at the project site who is responsible for the physical operation of the project. Non-hydrologic/hydraulic aspects of project operation and maintenance are not addressed herein. It is the intent of this manual to compile a comprehensive compendium of elements related to the management of water control systems, including discussions of:

(1) fundamentals of multipurpose water control projects and system regulation;

(2) techniques of preparing water control plans including regulation schedules, for a single project or system, for meeting all multipurpose objectives in accordance with project planning and design, and other objectives as necessary;

(3) methods for collecting, processing and disseminating basic data required for real-time management of water control projects and systems;

(4) methods for analyzing river and reservoir systems on a real-time basis to determine the most suitable regulation of projects, including utilization of automatic data processing techniques for simulating the response of hydrologic systems;

(5) problems and solutions related to environmental, social, economic and aesthetic aspects of water management;

(6) methods for making and implementing real-time water control decisions;

(7) administrative and coordination requirements by the Corps of Engineers for developing water control plans and manuals for an individual project or system, organizing water management activities in Division and District offices, and reporting current conditions of water control systems to higher authority; and

(8) methods for coordinating water management activities with others, on a local, regional and national basis, and providing information to the public regarding the current management of water control systems.

b. Chapter 2. Chapter 2 is a generalized description of the objectives and principles for the management of water for various multipurpose uses, including:

- Flood Control
- Navigation
- Hydropower
- Water Supply
- Water Quality

- Recreation
- Fish and Wildlife

The specific requirements for any one of the above-listed elements (functional, economic, environmental, social and aesthetic) are unique to a given river basin, and it is not intended to present detailed solutions. The manual describes each element, insofar as the principles apply to projects generally, and the necessity for considering all elements as well as the safety and integrity of the project.

c. Chapter 3. This Chapter covers the technical aspects of developing water control plans, which often encompass multipurpose and multiproject systems. Even in the case of a single purpose project, there are often important social and/or environmental aspects to be accounted for in the overall management of a river system. The manual provides guidelines for the formulation of detailed regulation criteria, which are based largely on planning and design studies, together with the use of techniques for water management to attain the overall goals. Preparation of water control diagrams, which include the regulating criteria in the form of guide curves and release schedules, are discussed. There is also a section which deals with requirements contained in water control agreements for non-Corps projects, as set forth in the revision of 33 CFR 208.11, published in the Federal Register, Vol. 43, No. 199, October 13, 1978.

d. Chapter 4. This chapter contains a brief description of the design of hydraulic facilities at water control projects. These include spillways, spillway gates, regulating outlets, bypass and diversion structures, interior drainage facilities, navigation locks, hydropower facilities, fish passage facilities, and special devices for regulating the quality of water released from a reservoir. Special emphasis is placed on the methods for controlling floods through the combined use of spillway gates and/or regulating outlets in order to utilize surcharge storage in reservoirs. Also mentioned are special water control management problems involved in the utilization of bypass structures, hydropower facilities, navigation locks, and fish passage facilities.

e. Chapter 5. This chapter summarizes the methods available for collecting, processing, storing and disseminating basic data for project regulation. These data systems may include any or all of the following:

- manual observations
- land line or radio communication systems for automatic retrieval of remote data
- satellite communication and sensing devices
- meteor-burst communication devices
- various types of sensors, processors, and relay devices necessary for obtaining and relaying remote hydrometeorologic and project data
- centralized automatic data processing facilities required for accessing and controlling the flow of data

This chapter also presents methods for coordinating data collection with other organizations, and the use of cooperatively developed data systems.

f. Chapter 6. Chapter 6 of the manual contains methods of hydrologic analysis which are directly applicable to management of water control systems. These include generalized computer techniques to simulate the continuous natural response of hydrologic and river systems, combined with the effects of project regulation on conditions of streamflow and river stages. These simulations are used to evaluate the effects of alternative conditions or assumptions in forecasting streamflows and project regulation. There is a description of meteorological assessments and forecasts that are important to project regulation. Systems analysis techniques also include methods for analyzing and projecting long-term regulation of projects for several months to a year in advance. These projections are based on known or assumed conditions of stream and operating criteria. These analyses are useful in evaluating alternatives in system regulation and adjusting the water control plan for flood control, hydropower, irrigation, navigation, water quality, fishery requirements, or other project purpose as may be required to assess the particular observed and projected conditions of hydrology and project regulation on the overall management of the water. Other aspects of hydrologic analysis include reservoir evaporation, effect of ice and wind, streamflow determination, hurricanes, tsunami waves, tidal effects, artificial flood waves, ground water effects, effects of changing channel capacities downstream from projects, and the effect of forest removal and urban development on runoff.

g. Chapter 7. This chapter presents the methods for integrating system guidelines for water control management, criteria and goals for scheduling water releases. The specific schedules are developed utilizing all existing current information, hydrometeorological data, project data, and projections developed by simulation techniques. There is a discussion of organization and staffing required to perform this function, methods of arriving at daily water control decisions, and how water control decisions may be disseminated and implemented at the project level. Also, methods for coordinating water releases, streamflow and regulation forecasts with other interests are discussed. There is a description of requirements of regulation during floods or other emergency conditions, as opposed to normal routine regulation, and methods for disseminating vital information to the news media and the general public.

h. Chapter 8. Chapter 8 deals with the administrative and coordination requirements of the Corps in managing water control systems. There are discussions of the role of the Corps in the regulation of international rivers and the authority for regulating projects constructed by other entities in the United States. The content of this chapter is derived primarily from existing Engineering Regulations (ER's) in summarizing the requirements for administrative control by the Corps.

i. Chapter 9. This chapter discusses the preparation of water control documents. These documents include standing instruction to project operators, water control plans and manuals.

1-3. References

a. Engineer Regulations and Manuals. The following regulations, manuals, and other publications define policy and basic methods directly related to water management activities by the Corps of Engineers.

- (1) ER 15-2-13, Mississippi Water Control Management Board
- (2) ER 15-2-14, Committees on Tidal Hydraulics, Channel Stabilization and Water Quality
- (3) ER 500-1-1, Natural Disaster Procedures
- (4) ER 1105-2-20, Project Purpose Planning Guidance

- (5) ER 1110-2-50, Low Level Discharge Facilities for Draw-Down of Impoundments
- (6) ER 1110-2-240, Water Control Management
- (7) ER 1110-2-241, Use of Storage Allocated for Flood Control and Navigation at Non-Corps Projects
- (8) ER 1110-2-248, Requirements for Water Data Transmission using GOES/DCS
- (9) ER 1110-2-249, Management of Water Control Data Systems
- (10) ER 1110-2-1150, Engineering after Feasibility Studies
- (11) ER 1110-2-1400, Reservoir Control Centers
- (12) ER 1110-2-1402, Hydrologic Investigations Requirements for Water Quality Control
- (13) ER 1110-2-1454, Corps Responsibility for Non-Federal Hydroelectric Power Development under the Federal Power Act
- (14) ER 1110-2-1455, Cooperative Stream Gaging Program
- (15) ER 1110-2-2901, Construction Cofferdams
- (16) ER 1110-2-1941, Drought Contingency Plans
- (17) ER 1125-2-308, Radio Frequency and Call Sign Assignments
- (18) ER 1130-2-334, Reporting Water Quality Management Activities at Corps Civil Works Projects
- (19) ER 1130-2-415, Water Quality Data Collection Interpretation and Application Activities
- (20) ER 1130-2-419, Dam Operations Management Policy
- (21) 33 CFR 208.11 (ER 1110-2-241) (Revised), Part 208, Flood Control Regulation, Use of Storage Allocated for Flood Control and Navigation Purposes, Published in Federal Register., Vol. 43, No. 1999, October 13, 1978
- (22) EM 1110-2-1201, Reservoir Water Quality Analysis

- (23) EM 1110-2-1405, Flood Hydrograph Analysis and Computation
- (24) EM 1110-2-1406, Runoff from Snowmelt
- (25) EM 1110-2-1408, Routing of Floods through River Channels
- (26) EM 1110-2-1412, Storm Surge Analysis
- (27) EM 1110-2-1413, Hydrologic Analysis of Interior Areas
- (28) EM 1110-2-1602, Hydraulic Design of Outlet Works
- (29) EM 1110-2-1603, Hydraulic Design of Spillways
- (30) EM 1110-2-1604, Hydraulic Design of Navigation Locks
- (31) EM 1110-2-1611, Layout and Design of Shallow-Draft Waterways
- (32) EM 1110-2-1701, Hydropower
- (33) ETL 1110-2-231, Initial Reservoir Filling Plan
- (34) ETL 1110-2-251, Preparation of Water Control Manuals

b. Other Technical Publications. Appendix A consists of a selected bibliography of literature pertaining to management of water control systems.



Figure 1-1. Foster Joseph Sayers Dam, Bald Eagle Creek,
Pennsylvania; Baltimore District